

*Citation for published version:*

Neville, A, Kopala-Sibley, DC, Soltani, S, Asmundson, GJG, Jordan, A, Carleton, RN, Yeates, KO, Schulte, F & Noel, M 2021, 'A longitudinal examination of the interpersonal fear avoidance model of pain: the role of intolerance of uncertainty', *Pain*, vol. 162, no. 1, pp. 152-160. <https://doi.org/10.1097/j.pain.0000000000002009>

*DOI:*

[10.1097/j.pain.0000000000002009](https://doi.org/10.1097/j.pain.0000000000002009)

*Publication date:*

2021

*Document Version*

Peer reviewed version

[Link to publication](#)

This is the author accepted manuscript of an article published in final form as Neville, Alexandra, Kopala-Sibley, Daniel, Soltani, Sabine, et al. A longitudinal examination of the interpersonal fear avoidance model of pain: the role of intolerance of uncertainty. *Pain*. 2021;162(1):152-160. doi:10.1097/j.pain.0000000000002009.

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**A longitudinal examination of the interpersonal fear avoidance model of pain:  
The role of intolerance of uncertainty**

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Manuscript Pages: 29

Tables: 3

Figures: 2

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### Abstract

Youth with chronic pain and their parents face uncertainty regarding their diagnosis, treatment, and prognosis. Given the uncertain nature of chronic pain, and high comorbidity of anxiety among youth, intolerance of uncertainty (IU) may be critical to the experience of pediatric chronic pain. This study longitudinally examined major tenets of the Interpersonal Fear Avoidance Model of Pain, and included parent and youth IU as key factors in the model. Participants included 152 youth with chronic pain ( $M_{age}=14.23$  years; 72% female) and their parents (93% female). At baseline, parents and youth reported on their IU and catastrophic thinking about youth pain; youth reported on their fear of pain, pain intensity, and pain interference; and parents reported on their protective responses to child pain. Youth reported on their pain interference three months later. Cross-lagged panel models, controlling for baseline pain interference, showed that greater parent IU predicted greater parent pain catastrophizing which, in turn, predicted greater parent protectiveness, greater youth fear of pain, and subsequently greater youth 3-month pain interference. Youth IU had a significant indirect effect on 3-month pain interference via youth pain catastrophizing and fear of pain. The results suggest that parent and youth IU contribute to increases in youth pain interference over time via increased pain catastrophizing, parent protectiveness, and youth fear of pain. Thus, parent and youth IU play important roles as risk factors in the maintenance of pediatric chronic pain over time and may be important targets for intervention.

### **A longitudinal examination of the interpersonal fear avoidance model of pain: The role of intolerance of uncertainty**

The experience of pediatric chronic pain is marked by uncertainty. For youth with chronic pain and their parents, uncertainty regarding a chronic pain diagnosis and treatment may fuel beliefs that something serious was missed by clinicians and a search for the ‘right’ diagnosis [57]. Meanwhile, parents of youth with chronic pain report living in a state of uncertainty regarding their child’s condition and prognosis, their parental role, and the future, making it difficult to move forward with daily life [39].

Intolerance of uncertainty (IU) is defined as a “dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty” (p. 31) [12]. IU is a key component of excessive worry [44] and anxiety disorders in general [12; 21], and is conceived of as a transdiagnostic dispositional risk factor for the development and maintenance of fear and anxiety-related psychopathology [12]. At the core of IU is a dispositional fear of the unknown [11], not unlike the fear many parents and youth report in their search to know the cause of their pain and whether it could be something more sinister [57]. Individuals high, versus low, in IU interpret ambiguous situations as more threatening [22], and IU has been postulated as directly and indirectly contributing to chronic pain [3]. Thus, youth high in IU may interpret the ambiguity of their pain experience as more threatening. Given the uncertain nature of pediatric chronic pain and the high comorbidity of anxiety among this population, IU may be critical to the experience of pediatric chronic pain. Nevertheless, IU has never been examined in this population.

Previous research has examined a variety of putative risk factors for fear-avoidance in chronic pain (e.g., anxiety sensitivity) [2; 10; 51]. IU may be particularly important for eliciting

threatening pain-related cognitions, emotions, and disability in pediatric chronic pain. The Interpersonal Fear Avoidance Model of Pain (IFAM) is a prominent conceptualization illustrating bidirectional relationships between parent and youth psychological and behavioral responses that influence youth pain disability/interference over time [32; 73]. Specifically, the model posits that when confronted with pain, youth may engage in catastrophic thinking that, in turn, drives pain-related fears and avoidance behaviour, ultimately resulting in pain disability/declines in functioning. Given that parental responses are critical to youth's experience of chronic pain, the model also illustrates the influence of parent pain catastrophizing, pain-related fears, and behavioral (e.g., protectiveness) responses on youth's pain-related cognitions, fears, behaviour, and disability [32; 73].

The current study is the first to longitudinally examine the roles of parent and youth IU as risk factors to core components of the IFAM [32; 73]. Specifically, we predicted that, in a longitudinal study of youth chronic pain, 1) youth IU at baseline would predict 3-month pain interference through youth pain catastrophizing and fear of pain, and 2) higher parent IU at baseline would predict 3-month pain interference through parent pain catastrophizing, parent protectiveness, and youth fear of pain.

## **Methods**

The current analysis is part of the Pain and Mental Health in Youth study (PATH), a larger Canadian longitudinal program of research investigating internalizing mental health disorders in youth with chronic pain. The aims of the broader study are to examine a myriad of neurobiological, cognitive, behavioral, and social factors underlying co-occurring mental health symptoms and chronic pain. The current study was designed with unique and specific goals to examine parent and youth IU in the IFAM; thus, the current goals are distinct from the

previously published papers pertaining to sleep disturbances, diagnostic uncertainty, and daily parent-child relationships [56; 57; 65].

## **Participants**

Participants included 152 youth with chronic pain and one of their parents recruited from a tertiary-level pediatric chronic pain program. Youth were eligible for the study if they were between 10-18 years of age and identified by a health care provider as having chronic pain (i.e., pain  $\geq$  3 months [54]) without an underlying disease (e.g., cancer). Exclusion criteria for both the youth and parent included being unable to read/speak English, diagnosis of a severe cognitive disability, developmental disorder, schizophrenia spectrum or other psychotic disorders, or inability to access the internet.

## **Procedure**

All study procedures were approved by the institutional health Research Ethics Board. Parents were first approached by a member of the pain clinic staff for permission to be contacted by the research team. Parents and youth were then contacted by a member of the research team to assess eligibility, provide further information about the study, and obtain informed consent. Parents and youth consented or assented using an online consent (or assent) form and completed baseline questionnaires using Research Electronic Data Capture (REDCap), a secure online data collection tool [34]. Youth who were at least 14 years of age provided their consent to participate and signed a consent form. Youth who were below the age of 14 years were asked to provide their assent and signed an assent form. All participating parents provided their consent to participate. Additionally, for youth below the age of 14, parents provided consent for their child to participate in the study.

At the baseline assessment and 3-month follow-up, parents and youth completed psychometrically sound self-report questionnaires using REDCap [34]. Specifically, at baseline, parents reported on their own and their children's socio-demographic characteristics, as well as their own IU, catastrophic thinking about their child's pain, and protective responses to their child's pain. Youth completed measures assessing their IU, catastrophic thinking about their pain, and fear of pain, as well as pain intensity and interference. At 3-month follow-up, youth reported on their pain interference. Parents and youth each received a \$25 gift card for each assessment in which they participated.

## **Measures**

**Socio-demographic Characteristics.** Parents reported on their own and their child's age, gender, and race, as well as their annual household income.

**Youth Pain Characteristics.** Youth completed a commonly used pain questionnaire to measure child pain characteristics [64]. Specifically, youth reported the location of their body where they experience the most pain as well as how long their pain has been present in years and months. Pain frequency in the past seven days was rated on a 5-point Likert scale ranging from "not at all" to "daily." Youth reported their average pain intensity in the past seven days using a validated 11-point numeric rating scale (0 = "no pain", 10 = "worst pain possible") [15; 80].

**Youth Pain Interference.** Pain interference was assessed using the Pain Interference Subscale of the Patient-Reported Outcomes Measurement Information System (PROMIS) Pediatric Profile-25 [38]. The 4-item subscale was rated using a 5-point Likert scale from "never" to "almost always". A total score of pain interference is obtained by summing responses. This total is subsequently transformed into standardized T-scores used for analyses. In the

current sample, internal consistency for pain interference was good ( $\alpha = .82$  at baseline;  $\alpha = .85$  at follow-up).

**Parent and Youth Intolerance of Uncertainty.** Parents completed the 12-item Intolerance of Uncertainty Scale (IUS-12)[13] and youth completed the 12-item Intolerance of Uncertainty Scale-Revised (IUS-R)[81]. Both scales measure individual reactions to uncertain and ambiguous situations and the future [13; 81]. On the IUS-12, each item (e.g., “I can’t stand being taken by surprise”) is rated on a 5-point Likert scale from “Not at all characteristic of me,” to “Entirely characteristic of me”. On the IUS-R, each item (e.g. “I can’t stand it when things happen suddenly”) is rated on a 5-point Likert scale from “Not at all like me” to “Entirely like me”. On both scales, a higher total score indicates a higher level of IU. The IUS-12 has shown excellent internal consistency [13]. In the current sample, internal consistencies for the IUS-12 ( $\alpha = .94$ ) and IUS-R ( $\alpha = .94$ ) were both excellent.

**Parent and Youth Pain Catastrophizing.** The Pain Catastrophizing Scale-Child version (PCS-C) [18] and the Pain Catastrophizing Scale-Parent version (PCS-P) [31] were used to assess catastrophic thoughts about child pain. The PCS-C and PCS-P capture trait catastrophizing. Each scale contains 13 items rated on a 5-point Likert scale (anchors 0 = “not at all,” 4 = “extremely”). Items are summed to produce a total score. Lower scores indicate a lower level of pain catastrophizing. The PCS-C describes what a child might feel and think when they experience pain (e.g., “When I am in pain, I become afraid that the pain will get worse”). The PCS-P assesses how a parent might feel when his/her child is in pain (e.g., “When my child is in pain, I become afraid that the pain will get worse”). The PCS-C and the PCS-P have been previously validated in children with chronic pain and their parents and have demonstrated good validity and reliability [18; 31]. Parent and child trait catastrophizing have been linked to poorer



child functioning and increased pain [18; 33; 49; 50; 66]. Internal consistency for youth pain catastrophizing ( $\alpha = .94$ ) and parent pain catastrophizing ( $\alpha = .90$ ) was excellent in this sample.

**Parent Protective Responses to Youth Pain.** Parents reported on their responses to their child's pain using the Protect scale of the Adult Responses to Children's Symptoms (ARCS) [79]. Using a 5-point scale ranging from "never" to "always," parents reported on the frequency with which they engage in various behaviors (e.g., "Give your child special privileges") when their child has pain. The ARCS has been shown to be reliable and valid in samples of youth with chronic pain [59]. The current study used the ARCS scoring for a combined child and adolescent sample of youth with chronic pain, which uses 13 items [61]. Responses are averaged to provide a Protect score, with higher scores indicative of greater parent protective responses. The ARCS protect scale had good internal consistency ( $\alpha = .90$ ) in the current sample.

**Youth Fear of Pain.** The Fear of Pain Questionnaire, child report (FOPQ-C), is a 24-item self-report inventory used to assess pain-related fears and avoidance behaviors [72]. The FOPQ-C has two subscales: Fear of Pain and Avoidance of Activities. Each item is scored from 0 ("strongly disagree") to 4 ("strongly agree"). Total scores are calculated by summing items. Higher scores indicate higher levels of pain-related fear and avoidance. The FOPQ-C is both highly reliable and has been validated for use in the pediatric chronic pain population [72]. The Fear of Pain subscale ( $\alpha=.94$ ), Avoidance of Activities subscale ( $\alpha=.91$ ), and total FOPQ-C ( $\alpha=.95$ ) had excellent internal consistencies in the current sample.

## Statistical Analyses

Descriptive statistics and correlational analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 24 [37]. Structural Equation Modeling was carried out using AMOS 25.0 [1]. Subsequent analyses consisted of cross-lagged panel models

carried out using AMOS 25.0. The current sample size exceeds that required on the basis of a priori statistical power calculations. Power analyses with .80 power ( $\alpha = .05$ ) suggest a sample of 144 would provide 80% power to detect a small to medium effect size ( $f^2 = .11$ ) [74]. Analyses were initially adjusted for age and gender. In the initial model (Figure 1), baseline parent IU predicts baseline parent pain catastrophizing which, in turn, predicts baseline parent protective responses. The three variables, as well as baseline youth pain interference and intensity and youth's IU, then predict youth's baseline pain catastrophizing. All six variables then predict youth's fear of pain which, in turn, predicts 3-month pain interference, which is also predicted by baseline pain interference. By adjusting for baseline levels of pain interference on 3-month pain interference, the model can be used to examine whether baseline variables predict change over time in pain interference. Most variables in the current study were interrelated; however, demonstrating the *incremental* predictive utility of each variable relative to each other variable is important for understanding the unique role of each variable in our model. Accordingly, we initially included all possible paths to ensure that paths that were not the focus of the current study, but that were potentially statistically significant, were retained in the final model [35].

Measures of goodness of fit included chi-square, ratio of chi-square to degrees of freedom, comparative fit index (CFI), and root-mean-square error of approximation (RMSEA). Generally, a  $\chi^2/df$  less than 2 [14], CFI values greater than .90 [36], and a RMSEA of less than .08 with a non-significant  $p$  of close fit (pClose) [42] indicate acceptable fit. AMOS cannot estimate indirect effects in the presence of missing data. Accordingly, missing data were singly imputed via regression imputation with Full Information Maximum Likelihood (FIML) estimation. Estabrook and Neale [25] note that FIML most accurately estimates individual scores with missing data relative to other methods such as mean imputation. The FIML approach is

generally acknowledged to be preferable to other methods for dealing with missing data, such as listwise deletion or mean imputation, as these latter approaches are more likely to yield biased estimates [48; 55; 69]. A bias-corrected bootstrapping procedure was used to estimate confidence intervals of indirect effects. Bootstrapping is a non-parametric method based on resampling (5,000 in the current study) with replacement [8; 71]. We present 95% confidence intervals as well as parameter estimates associated with the indirect effect. Specifically, we examine indirect effects of baseline parent and youth pain catastrophizing and IU, as well as parent protectiveness, on three-month youth pain interference via each baseline variable (see Figure 1). For clarity, in Figure 2, the paths included in the mediation analyses are bolded. On the basis of Wald tests, and in the interest of parsimony, non-significant paths were removed in order beginning with the least significant paths [68; 75]. Following the deletion of non-significant paths, chi-square difference tests were conducted to ensure the trimmed model did not fit the data significantly worse as compared to the full model. Full details of this model trimming are available upon request.

## **Results**

### **Missing Data**

Variables had a range of 0.7% - 15.1% missing data (youth IU = .7%; youth pain intensity = 2.6%; baseline youth pain interference = 2.6%; youth catastrophizing = 3.3%; parent protective responses = 3.9%; parent IU = 3.9%; parent catastrophizing = 5.9%; youth fear of pain = 10.5%; follow-up pain interference = 15.1%). Estimation of missing data using FIML is only valid when data are missing at random (i.e., no systematic biases affect which participants have missing data). Little's [47] Missing Completely at Random (MCAR) test confirmed that

missingness was unrelated to any variable in our study:  $\chi^2(236) = 258.85, p = .15$ . Data can thus be viewed as missing at random for analyses.

### **Descriptive Statistics**

Participants included 152 youth with chronic pain ( $M_{age}=14.23$  years; 72.4% female, Range=10-18 years) and one of their parents (93% female). Youth were enrolled from headache (65%), complex pain (34%), or abdominal pain (1%) clinics. Youth reported experiencing the most pain in their head (71.1%), muscles and joints (26.3%), stomach (17.8%), legs (15.1%), and chest (11.8%), or other location (e.g., mouth) (27%). At baseline, youth reported an average pain intensity level in the past week of 5.59 out of 10 ( $SD = 1.86$ ) and an average pain duration of 3.21 years ( $SD = 3.17$ ). Forty-eight percent ( $n = 73$ ) of youth reported that they had experienced pain daily over the past week. Sociodemographic data are presented in Table 1.

Table 2 reports the means and standard deviations of the baseline and 3-month follow-up key variables. Correlations among key variables are reported in Table 3. Females reported significantly greater 3-month pain interference than males ( $p < .05$ ). Older youth reported higher levels of pain interference ( $r = .17, p < .05$ ), IU ( $r = .17, p < .05$ ), and fear of pain ( $r = .22, p < .01$ ).

### **Structural Equation Modelling**

Our initial model (Figure 1) produced a good fit to the data:  $\chi^2(3) = 6.033, p = .11, \chi^2/df = 2.011, CFI = .992, RMSEA = .082, pClose = .224$ . The two FOPQ-C subscales (Fear of Pain and Avoidance of Activities) were highly correlated ( $r = .65, p < .01$ ), and comprised the total Fear of Pain Scale score. When these subscales were tested separately, neither showed significant effects on 3-month pain interference; however, when tested as a total score, a significant effect on 3-month pain interference was found. This suggests that each subscale is

likely explaining overlapping portions of variance in 3-month pain interference and, therefore, cancel out the effect of each other. Therefore, the total score of the FOPQ-C was used to capture both aspects of Fear of Pain: fear and avoidance. Youth age and gender were not significantly related to any outcome and were dropped from the model. Parent IU was not correlated with youth's pain interference or intensity, while parent pain catastrophizing was not correlated with youth pain intensity, interference, or IU. Parent protectiveness was only correlated with youth pain intensity. All non-significant correlations were trimmed from the model. Regarding regression paths, parent IU, parent pain catastrophizing, and parent protectiveness were not significantly related to youth pain catastrophizing. Youth pain intensity, parent pain catastrophizing, and parent IU were also not related to youth's fear of pain. Finally, parent IU, parent pain catastrophizing, parent protectiveness, youth pain intensity, and youth IU were not related to 3-month youth pain interference. Therefore, these paths were removed from the model.

The trimmed model (Figure 2) showed an excellent fit to the data:  $\chi^2(20) = 21.62, p = .36, \chi^2/df = 1.08, CFI > .99, RMSEA = .023, pClose = .746$ . Greater parent IU predicted greater parent pain catastrophizing which, in turn, predicted greater parent protectiveness, and subsequently greater youth fear of pain. Youth pain intensity and pain interference as well as IU independently (i.e., controlling for each other) predicted increased youth pain catastrophizing. Youth pain catastrophizing, IU, and pain interference independently predicted youth fear of pain. Pain interference showed moderate rank-order stability. Over and above baseline pain interference, youth fear of pain predicted increases over time in youth pain interference. This suggests that youth's fear of pain may contribute to increases in pain interference over time, and that parent factors are linked to youth fear of pain.

A significant indirect effect was found from greater baseline pain intensity to greater 3-month pain interference via greater pain catastrophizing followed by fear of pain ( $b = .027$ , 95% CI [.010, .057],  $p = .012$ ). A significant indirect effect also was found from greater baseline pain interference to greater 3-month pain interference via youth pain catastrophizing followed by youth fear of pain ( $b = .100$ , 95% CI [.06, .159],  $p < .009$ ). Finally, a significant indirect effect was found for youth IU on 3-month pain interference via youth pain catastrophizing and fear of pain ( $b = .132$ , 95% CI [.078, .198],  $p < .009$ ). These results suggest that youth pain intensity and IU may contribute to increases in pain interference over time via increased pain catastrophizing and fear of pain. They also suggest that pain interference maintains itself over time via pain catastrophizing and fear of pain.

### Discussion

The current study is the first to longitudinally examine the IFAM [73] and include parent and youth IU as putative risk factors in the model. The current results supported the hypothesis that greater parent IU predicts greater parent pain catastrophizing, which in turn predicts greater parent protectiveness and youth fear of pain (i.e., fear and avoidance behaviors), and subsequently 3-month youth pain interference. Youth IU at baseline also influenced 3-month youth pain interference via indirect effects involving youth pain catastrophizing and fear of pain. Consistent with the IFAM, greater baseline pain intensity also predicted greater 3-month pain interference through greater pain catastrophizing and fear of pain. Thus, while tested among youth whose pain was already chronic, the results suggest that following a painful experience (pain intensity), the worsening of chronic pain begins with a cognitive appraisal of the pain as threatening (catastrophizing), followed by increased fear of pain (a fear response and avoidance behaviors), which can be expected to facilitate increased pain interference over time.

Furthermore, per previous research and theory [3; 12], IU appears to serve as a risk factor in the current model; specifically, youth who were high in IU tended to appraise their pain with greater catastrophizing. The current results are consistent with previous research identifying IU as a transdiagnostic risk factor across various mood and anxiety disorders [9; 12; 70].

In research with adults, high IU has been implicated in generalized anxiety disorder [41; 43], social anxiety disorder [6], panic disorder and agoraphobia [5; 52], obsessive-compulsive disorder [46], PTSD [27], and depression [30]. Comparatively less research has examined the construct of IU in children and adolescents; however, the extant research to date echoes the findings in adults. For example, high IU has been implicated in social anxiety in adolescents [7]. IU has also been found to be positively associated with worry in children [28; 40] and adolescents [76]. Furthermore, high levels of IU have been shown to differentiate clinically significant levels of anxiety in children [17; 44]. An investigation into the associations between IU and health anxiety found significant positive associations between IU, anxiety sensitivity, and a range of anxiety symptoms (e.g., panic, separation anxiety, social anxiety, generalized anxiety, physical injury fears), further supporting the transdiagnostic role of IU in anxiety in youth [82].

The current study is the first to introduce and demonstrate the role of IU in the experience of pediatric chronic pain. In the current study, youth IU was significantly correlated with youth pain interference at baseline and 3-month follow-up. Previous research has shown that high IU is associated with higher self-reported pain severity in unpredictable, acute pain experiences [4]. In addition to its influence on acute pain, IU has particular implications for individuals affected by chronic pain, where the etiology of pain is often unknown, and where uncertainty is therefore especially salient. The current results suggest that IU may influence pain-related outcomes, in part by influencing other key pain-related constructs, such as pain catastrophizing. Individuals

who are high, versus low, in IU have been shown to interpret ambiguous situations as more threatening [22]. Thus, for youth who are high in IU, pain, which is often uncertain and ambiguous, may be perceived as more threatening. Catastrophizing, in turn, is associated with increased pain and pain-related dysfunction [19; 77]. The results underscore the importance of continued research designed to improve our understanding of how IU may influence the chronic pain experience in order to inform the refinement of treatment, perhaps emphasizing reducing IU in impacted youth.

With respect to our understanding of fear-avoidance models of chronic pain, comprehensive reviews of IU and relevant theoretical models have suggested that IU can be distinguished from other fear-related constructs such as anxiety sensitivity and fear of pain, in that the latter constructs are characterised by fear in response to a particular stimulus or object [3; 11; 12]. In contrast, fear experienced as a consequence of IU stems from the absence of stimuli or information [12]. Moreover, previous research has found that the associations between IU and emotional disorders persist even when controlling for other dispositional risk factors such as anxiety sensitivity, neuroticism, and negative affect, pointing to the unique role of IU in psychopathology [6; 53] and, by extension, theoretical models that seek to explain the intersection of psychopathology and chronic pain.

In the current study, greater parent IU predicted greater parent pain catastrophizing and protectiveness, which, in turn, predicted greater youth fear of pain (fear and avoidance behaviors) and greater 3-month youth pain interference. The current results are consistent with recent investigations of the IFAM [73]. Specifically, Simons and colleagues' [73] found that parent behavior (parent protectiveness, minimization responses, and avoidance) directly influenced child avoidance behavior, which subsequently predicted child disability. Parent



distress (fear and catastrophizing) also indirectly influenced child avoidance behavior through parent behavior [73]. The current study did not investigate parent pain-related fear, through which the IFAM posits parent pain catastrophizing influences protective behavior. Parent pain-related fear should be included in future longitudinal examinations of the IFAM. Further, inconsistent with the IFAM, parent pain catastrophizing was not significantly related to youth pain catastrophizing in the current study. In several recent studies parent protectiveness assessed at one point in time was not associated with youth chronic pain outcomes [45; 67; 78]. Rather than directly impacting youth pain outcomes, our results suggest that, consistent with the IFAM, parent protective responses may influence youth behaviors, which subsequently influence youth pain. Recent evidence also points to the need to assess parent behaviors using ecological momentary assessment. Increased parent protective responses measured daily across 7 days has predicted higher youth pain unpleasantness, pain interference, and pain intensity [56]. Parent protective responses, which have been found to be dynamic and variable from day to day [56], may not be adequately captured by the static measure used in the current study.

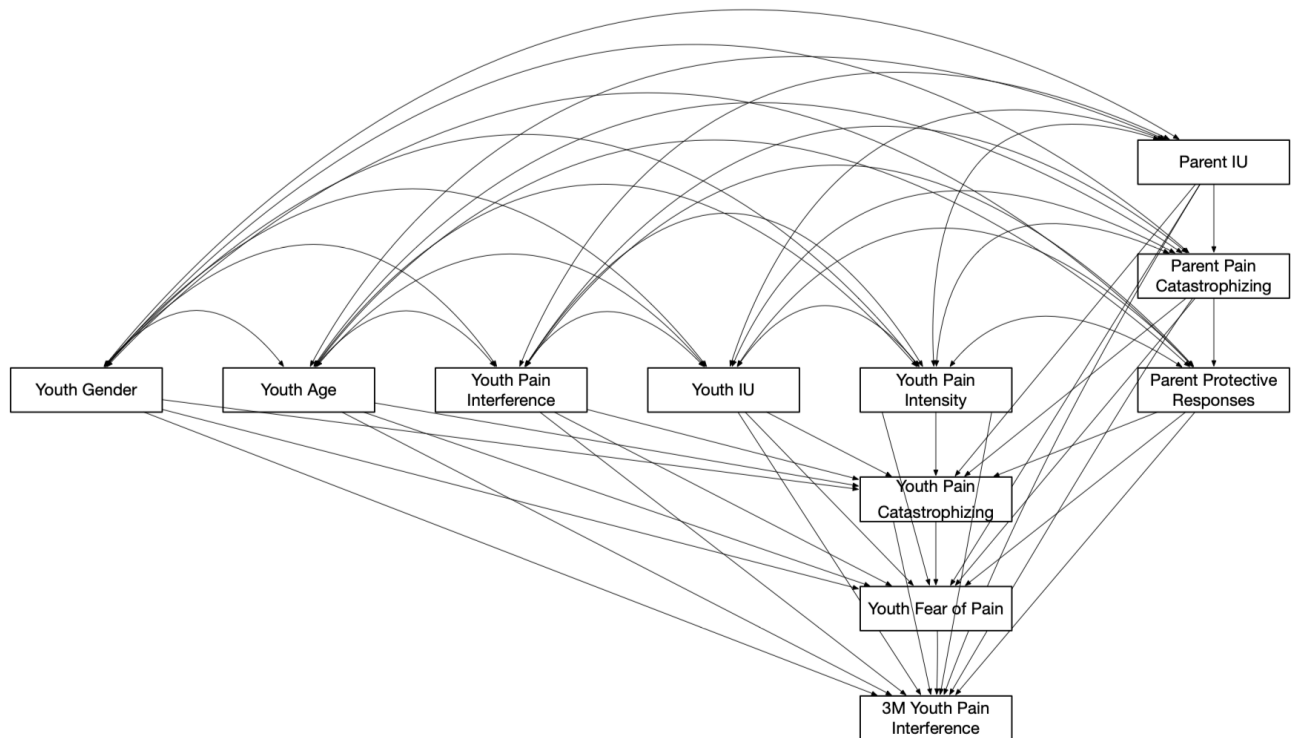
The current study has limitations that also provide directions for future research. First, although the analytical model is in line with the IFAM and pain interference was assessed longitudinally, most variables were assessed at a single time point. Thus, strong conclusions about the directions of effects cannot be drawn. Indeed, as proposed in this model, some effects are likely bidirectional. Prospective longitudinal analyses are needed to provide an ideal test of the current model. In order to prospectively examine the chronification of pain, future research should investigate first onset pain complaints or surgery/injury models to investigate how early factors influence the transition from acute to chronic pain. Furthermore, the current study investigated pain interference rather than functional disability, which is the core outcome

proposed in the IFAM. The current measure of pain interference was chosen as a pain-specific patient-oriented measure [20], which has been used extensively in the pediatric chronic pain literature [58; 62; 63]. Also, as stated previously, the FOPQ-C includes both fear of pain and avoidance behavior subscales. Based on the high correlations between these subscales, fear of pain and avoidance behavior subscales were aggregated into a single total fear of pain scale rather than assessed separately as the IFAM proposes. Finally, consistent with studies of tertiary pediatric chronic pain programs, the current sample was predominantly white and of high socioeconomic status, and most parent participants were mothers. Future research should also investigate how fear avoidance constructs may differ between youth with comorbid and non-comorbid pain conditions.

The current results highlight several potential targets of intervention for youth with chronic pain. In support of cognitive behavioral therapy that is already used for youth with chronic pain [29], youth cognitions (catastrophizing) and behavior (avoidance) were identified as key components in the maintenance of pediatric chronic pain. Given that youth IU was found to be a risk factor in the current model, other transdiagnostic cognitive-behavioral treatments targeting IU may also be warranted. Among adults, IU has been targeted in transdiagnostic treatment [9] using the Unified Protocol for the Transdiagnostic Treatment of Emotional Disorders (UP) [24; 26]. Among individuals with anxiety disorders (generalized anxiety disorder, social anxiety, obsessive compulsive disorder, panic disorder, posttraumatic stress disorder), Boswell and colleagues found a decrease in IU over the course of UP treatment [9]. Moreover, greater reductions in IU were associated with reduced anxiety and depression symptom severity [9]. The Unified Protocol for Transdiagnostic Treatment of Emotional Disorders in Children and Adolescents [23] may offer a new treatment option for youth with

chronic pain. The current results and the high comorbidity of anxiety disorders among youth with chronic pain [16; 60] suggest that targeting underlying transdiagnostic factors, such as IU, in treatment may be warranted and effective.

**Acknowledgments:** This research was supported by funding from the Vi Riddell Pediatric Pain Initiative, the Alberta Children's Hospital Research Institute, and the Chronic Pain Network awarded to Dr. Noel. Alexandra Neville is supported by a Canadian Institutes of Health Research (CIHR) Doctoral Award and an Alberta Innovates Graduate Studentship. The authors have no conflicts of interest to disclose.



*Figure 1.* Nontrimmed model of parent and youth intolerance of uncertainty (IU) as risk factors in the Interpersonal Fear Avoidance Model of Pain. For ease of interpretability, error variances are not included in the figure. 3M pain interference was assessed at 3-month follow-up.

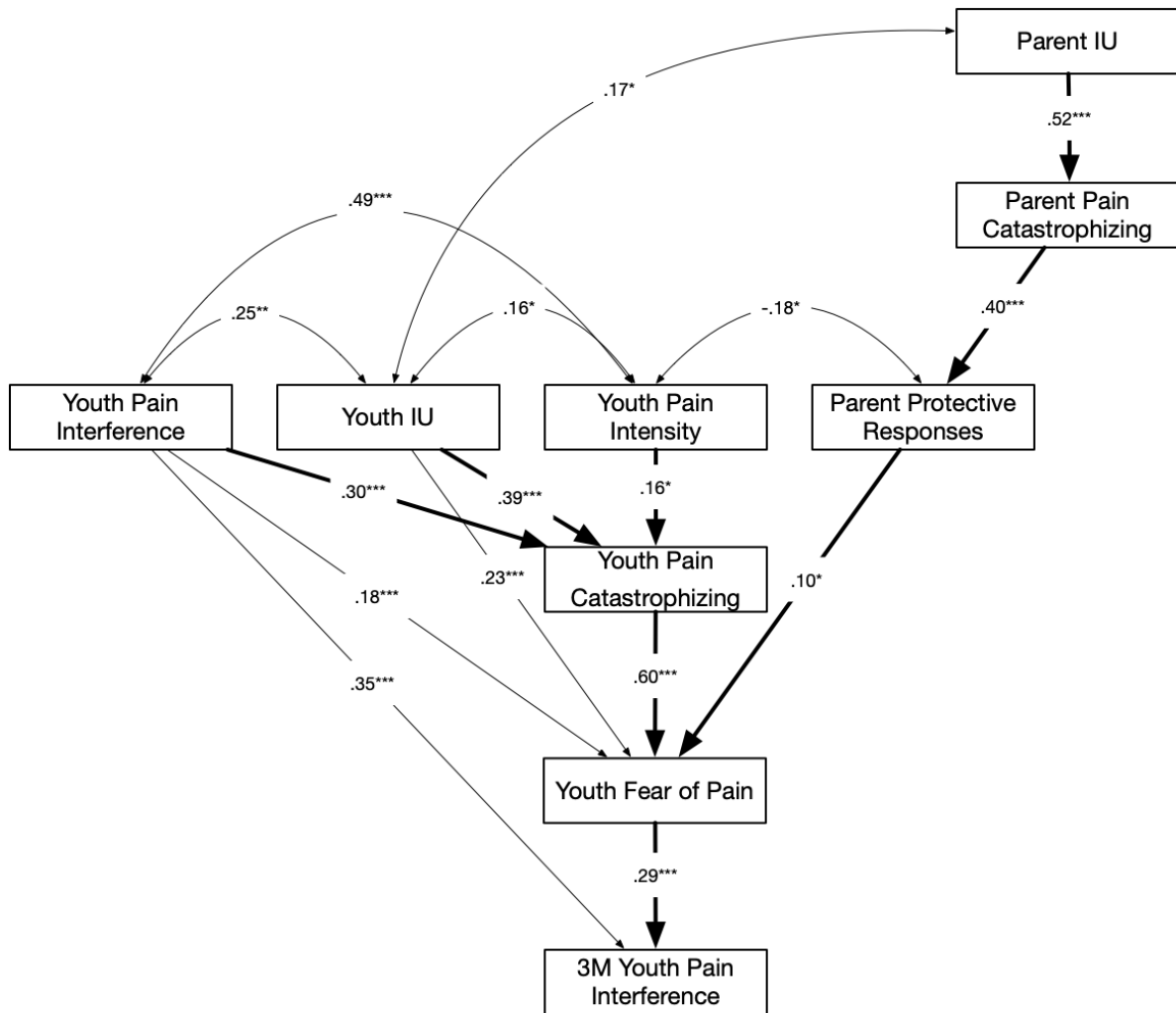


Figure 2. Trimmed model of parent and youth IU as risk factors in the Interpersonal Fear Avoidance Model of Pain. For ease of interpretability, error variances are not included in the figure. 3M pain interference was assessed at 3-month follow-up.

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$

Table 1

*Socio-Demographic Characteristics of the Sample*

Socio-Demographics	N=152
Youth mean age (SD), years	14.23 (2.25)
Youth gender (% female)	72.4
Parent gender (% female)	92.7
Relationship to the youth (%)	
Biological parent	97.3
Adoptive parent	2.0
Relative	.7
Youth race (%)	
White (Caucasian)	81.6
Two or more ethnicities	5.9
Other	3.9
Black	2.0
Aboriginal	1.3
Arab/West Asian	1.3
South Asian	1.3
Latin American	1.3
Filipino	0.7
Do not want to answer	0.7
Household income (%)	
<\$10,000 - \$29,999	4.6

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\$30,000 - \$59,999	11.2
\$60,000 - \$89,999	12.5
More than \$90,000	57.2
Do not want to answer	14.5

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Table 2

*Descriptive Statistics for Youth and Parent Variables*

Variable	<i>M (SD)</i>	<i>N</i>
Baseline		
Youth pain intensity (0-10)	5.59(1.86)	148
Youth pain interference (PROMIS), T-score	55.24(9.16)	148
Youth IU (IUS-R)	25.43(11.09)	151
Parent IU (IUS)	22.61(9.28)	146
Youth Catastrophizing, (PCS-C), total	18.67(12.10)	147
Parent Catastrophizing, (PCS-P) total	13.92(8.41)	143
Youth fear of pain	30.90(20.57)	136
Parent protective responses (ARCS protect scale), mean	1.39(.73)	146
3-Month Follow-up		
Youth pain interference (PROMIS), T-score	52.80(9.60)	129

*Note.* Youth pain interference possible T-score range = 36.7-74; IUS and IUS-R possible score range = 12-60; PCS-P and PCS-C possible total score range = 0-52; Youth fear of pain possible score range = 0-96; ARCS Protect Scale possible score range = 0-4



Table 3

*Correlations Among Variables of Interest*

Variable	1	2	3	4	5	6	7	8	9
1. Youth pain interference	-	.48***	.50***	.25**	.49***	.50***	.05	.17*	-.03
2. 3M youth pain interference		-	.25**	.25**	.39***	.43***	.15	.12	-.13
3. Youth pain intensity			-	.14	.37***	.32***	-.06	.10	-.17*
4. Youth IU				-	.49***	.53***	.18*	.02	.05
5. Youth Catastrophizing, (PCS-C), total					-	.77***	.15	.11	-.02
6. Youth fear of pain						-	.16	.13	.08
7. Parent IU							-	.51***	.34***
8. Parent Catastrophizing, (PCS-P) total								-	.37***
9. Parent protective responses (ARCS protect scale), mean									-

*Note.* \* $P < .05$ ; \*\* $P < .01$ , \*\*\* $P < .001$ . 3M pain interference was assessed at 3-month follow-up.

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